FOR THE BBC MICRO

STUDIO EIGHT
The Sound Studio

BEEBUG SOFT

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STUDIO 8

SOUND STUDIO SYSTEM
FOR THE BBC MICROCOMPUTER

By A G Williams

Acknowledgement:

The demonstration files DEMO1, DEMO2, DEMO3 and DEMO4 were composed and played by Philip Hill using Studio 8 in real time, without using the Music Editor for modification.

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Dolphin Place, Holywell Hill, St. Albans, Herts., AL1 1EX

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1. INTRODUCTION

1.1 The Features of Studio 8

Studio 8 is an advanced multi-level sequencer, consisting of 6 screens or 'pages'. Each page provides a specific function for the production of music, from defining envelopes and instruments to recording, editing, and filing the finished sequences.

A number of unique features set this package apart from other music programs available, including versatile sequencing, custom-designed enveloping facilities and the option of adding a full-size music keyboard.

Studio 8's six control pages are as follows:

STUDIO PAGE	allows playing, recording and editing in real time: Keyboard, Sequencer and Tape Simulator are all accessed from this screen
MUSIC EDITOR	a full-screen editor for use on all music files
ENVELOPE EDITOR	allows definition of 16 amplitude and pitch envelopes
INSTRUMENT DEFINER	allows definition of 32 instruments by name
KEYBOARD SETTINGS	allows reconfiguration of the keyboard, and add-on keyboard type
FILING SCREEN	load or save files of instruments, envelopes and sequences – also all * commands

1.2 Manual Conventions

In this manual specific keystrokes such as pressing RETURN, SHIFT, and the cursor keys, are indicated in reverse type thus: RETURN SHIFT ↑ ↓ ← →.

Definitions pertinent to the Studio 8 package are highlighted in **bold** text.

Any text displayed on the screen, including prompts and labels, appears in this `easy to read` font.

1.3 Getting Started

Studio 8 is loaded by typing:

```
CHAIN"STUDIO" RETURN
```

on a cassette system, or by auto-booting from disc. To auto-boot, hold down the **SHIFT** key, and tap **BREAK**.

On a cassette system the whole of Studio 8 is held in memory simultaneously, avoiding the necessity of loading separate sections as they come into use. Because of the length of Studio 8 code, this is not possible on a disc system, and the user is advised to leave his program disc in the drive (drive 0 if you have a choice) to facilitate further accesses. If you wish to use another drive for data, simply issue a `*DRIVE` command from the **Filing screen** (see section 7.2).

In addition to the main program files, both cassette and disc versions of Studio 8 carry a number of example data files called **DEMO1**, **DEMO2**, etc. Using the DEMO files to play music on the system is dealt with in appendix A. A fully worked example using Studio 8 is described in appendix B. You are recommended to turn to either or both of these appendices if you wish to produce "instant" results.

Once the package has been loaded, you will be confronted by the first of its control pages, the **Studio Functions** screen (see figure 1). This is the screen from which most of the real-time features of the package are accessed. These include the keyboard, sequencers, and the 8 track tape simulator. It will pay

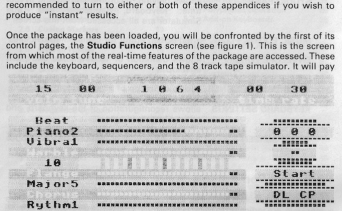


Figure 1

dividends to work carefully through the multitude of options available here. This screen is treated in the next section, and in fact the subsequent sections of the manual deal with each of the six screens in turn.

For the moment we will content ourselves with a brief description of the use of the function keys, which are common to all six screens, before terminating this section with a treatment of the keyboard.

1.4 Function Key Operation

Each page in Studio 8 displays a window at the bottom of the screen, showing the purpose of each function key for that page. In most cases the various settings can be altered by pressing the appropriate function key together with other keys such as the cursor keys, ↑ ↓ - _.

For instance, the **drive rate** for playback is shown at the top right of the display (default value 30). This value can be altered by pressing f6 together with the ↑ and ↓ keys. The cursor keys will auto-repeat when held down, to allow the values to change continuously.

In some cases, for example function keys f7 f8 and f9 in the Studio page, the operation is slightly different. However, in each case, the lower window fully prompts the user.

1.5 Selecting Pages CTRL

Although Studio 8 starts up in the **Studio page**, any of the 6 pages can be selected whenever required. For tape users, all pages are resident in memory, so there is no need for additional loading from tape. With disc, the program is split into two sections, so some pages are loaded from the disc as they are needed. All relevant information is shared between the different pages, to give fully integrated operation.

To choose a page, first hold down the CTRL key. The function window at the bottom of the screen will change to display the PAGE SELECTIONS available, with the current selection highlighted (see figure 2). With CTRL held down, pressing a corresponding function key, f0 to f5, will transfer control to the chosen page.

For example, CTRL f2 will call up the **Envelope Editor page**. Note that the function key window (when CTRL is released) now shows the functions available for the new page. CTRL f0 will return you to the **Studio page**, with everything as you left it.

```
        PAGE SELECTIONS
f0 studio      f1 editor
f2 envelopes   f3 instrmnts
f4 keyboard    f5 filing
```

Figure 2

1.6 Playing the Keyboard

The computer's QWERTY keys serve as a music keyboard when using 4 of the 6 pages provided in Studio 8. It is active in the following screens:

Studio Screen
Envelope Editor
Instrument Definer
Keyboard Settings

The arrangement is that of a small double-manual keyboard, with one row above the other. Figure 3 shows the note symbol in the top-left corner of each key, with the QWERTY symbol at the bottom-right.

If you load the package from scratch, you will find yourself in the Studio Screen, with a number of defaults set.

If you press **X** you will hear a note sound, and fade away. The active channel (coloured white on the screen) is the second of four available channels which may be directly played from the keyboard. It is currently set, as you can see, to P1 a n o 2, and as the note dies away you will see the simulated LED signal indicator drop back.

In fact a full scale of notes can be played on the computer keyboard between keys **X** to **B** (low octave) and **E** to **?** (high octave), with sharps and flats above these rows. Key **<>** then, gives the same note as key **E**.
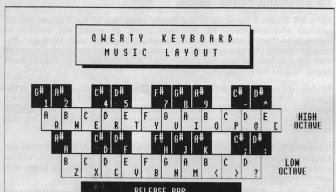


Figure 3

The corresponding piano keyboard layout is depicted near the bottom of the screen. The current note can be terminated at any time by pressing SPACE – this will cause the amplitude envelope to jump to its 'Release' phase.

1.6.1 Note Indicator

An indicator showing the note symbol will also be displayed on the keyboard unit, each time that a note sounds on the current channel. This is positioned below the corresponding key on the keyboard display, and fades down through light to dark colours. You may have noticed a C appear when pressing X earlier.

If a 'black' key is pressed, the # symbol will also appear, to indicate sharps. When SPACE is pressed, the rel indicator will light up (with a white line underneath) to signify that the note has released.

The note indicator also operates during playback of recorded music, for the currently selected channel. This can be useful when inserting, deleting and altering notes in a recording.

1.6.2 Octave Selection TAB

Two full octaves are available at any one time from the keyboard, but this range can be increased by selecting different octave values.

There are 3 settings available 01, 03 and 05. The current selection is shown on the left side of the keyboard unit, the default being 03. Pressing TAB will step through the selections. 01 selects octaves 1 and 2, 03 gives octaves 3 and 4, and 05 octaves 5 and 6.

You will notice that a few notes above and below these octaves can also be played. The notes in octave 6 and above are normally too high to be heard clearly with plain envelopes, but become useful when used with some pitch envelopes and sequences.

1.6.3 Operating Modes

Studio 8 permits the keyboard to be used in a number of ways, allowing **manual sustain**, **split keyboard**, and **polyphonic** operation. These modes are indicated by the M, S and P symbols which appear to the right of the keyboard display. Each may be toggled on or off independently using the controls shown below.

PRESS	LETTER	FUNCTION
SHIFT RETURN	M	Manual sustain
SHIFT DELETE	S	Split keyboard
SHIFT COPY	P	Polyphonic operation

The effect of these settings is fully explained in sections 6.4 to 6.6. Initially, all settings should be switched off, with none of the indicators lit; or in colour terms, all should have a magenta rather than a white underline.

But just to put Studio 8 through its paces for a moment you may like to try Polyphonic operation. This mode assigns the three available note channels sequentially to notes played from the keyboard, so that up to three notes may overlap or indeed play simultaneously.

Press **SHIFT COPY**, then try playing a few notes. You will immediately notice that the sustain of one note is not cut off when another is sounded. If you glance at the screen, you will also observe the sequential assignment of the notes played to the three sound channels in sequence.

The **M** option may also be engaged at this point. The effect of this is to give you *manual* control over the sustain phase of a note. In short, the longer you press a key, the longer the resultant note, up to a cut off point determined by the current instrument characteristics.

2. STUDIO PAGE

2.1 Introduction

The **Studio page** is the 'front panel' of the whole package, and is the one which the package enters on start-up. It may also be entered from any other page by pressing CTRL 10. The Studio page provides a multitude of facilities for real-time recording, mixing, editing and playback of music, using the QWERTY section of the keyboard as a music keyboard. In the Studio page, the keyboard is always active, and if you press the keys at any time, notes will be sounded corresponding to the currently active channel and instrument.

Apart from the function window at the bottom of the screen, the display is divided into 4 main sections:

1 The **keyboard** unit at the lower part of the display is common to other pages in the program, and is explained in section 1.6.

2 To the middle-left is the **mixing console**, displaying the channel setting on each row, and amplitude information for the notes on playback.

3 The middle-right shows the simulated **tape drive** unit. This incorporates a position counter, control setting for rewind, playback etc, cue marker display and editing functions for deleting and altering recorded notes.

4 The top banner shows additional information covering overall volume, tuning, metronome timer and drive rate. The 4-digit value in the middle of the row shows the current number of notes free.

Studio 8 provides 8 sound channels in which music may be played and recorded. These correspond to the 8 rows on the mixing console. From top to bottom the first four channels (noise plus 3 tone channels) will already be familiar to users of the BBC micro's `SOUND` command. The four lower channels are special sequence channels which make use of the noise and tone channels in combination, as explained later. Each channel row shows the instrument or sequence name that is currently selected, followed by a linear level indicator and fader control. You will see that the default names of the four instruments are `Beat`, `Piano2`, `Vibra1` and `Warble`; and that the four lower sequence channels are assigned to `Flange`, `Major5`, `Chorus` and `Rythm1`.

2.2 Drive Controls

The cursor keys ◀, ▶, ↖, ↘ provide playback, record, stop and fast-wind in the same way as a tape recorder. The current operation is shown

on the tape drive unit at the right-hand side of the display, below a 3-digit position counter.

2.2.1 Play and Record ↑ and SHIFT ↑

When ↑ is pressed, the position counter will begin to count forwards at 2 counts per second. Pushing RETURN will reset the counter to zero, and playback will stop.

Pressing ↑ together with SHIFT will set the tape drive to record. The operation indicator lights up in red, showing that music played on the keyboard will be recorded in memory.

After becoming familiar with the keyboard layout explained in section 1.6, record a few notes as follows:

Press SHIFT ↑ to start recording
Play a few notes from the keyboard
Press RETURN

Notice that the **notes-free** indicator (middle of the top row) decrements as each note is recorded. Pressing ↑ will play back the recording, accompanied by the note-indicator below the keyboard unit.

While recorded music is playing back, it is still possible to play and record more notes from the keyboard, on any channel. To do this, reset the counter by pressing RETURN, then set the tape to RECORD by pressing SHIFT ↑. You will hear all the sounds that you have recorded, as the tape plays; but any further notes that you play while the tape progresses will be added to the recording.

Try this by adding extra notes between the ones you have already recorded. This facility allows music to be built up gradually and altered as required.

2.2.2 Fast-wind ←

Rewind and fast-forward is achieved by holding down the ← and → keys respectively. The position counter on the tape-drive unit will always indicate the correct position in the recording during this operation.

Fast-forward will continue to operate after the last note in a recording has been passed, up to a given limit. The limit is found by adding 240 to the counter value at the position of the last note. If the last note is recorded at counter value 130, then, fast-forward will operate until the counter shows 370, when it will automatically stop. As more notes are recorded, the end position will move further up.

When the end position is reached, the **cue-marker** display (below the operation indicator) will show the *END* message. Pressing RETURN (or

rewinding) will change the marker name back to `Start`. Section 2.6 gives further details on using the cue-marker facility.

2.2.3 Stop ↓ and RETURN

↓ will stop the music during the playback/record process. Pressing RETURN key will also perform a Stop, and jump automatically to the beginning of the tape.

2.2.4 Erase 10

To clear memory of the current recording (ie to wipe clean your 8 track tape), press 10 to select the `Cancel` option. The function window will change to offer a choice of two options. Pressing 10 will erase the recording, while ESCAPE will cancel the operation. The `Cancel Looping` option will be explained in section 2.14.3.

2.3 Channel Selection 10 ↑ and 10 ↓

The four sound channels used in Studio 8 are presented as alternating blue/magenta rows on the left of the display, channel 0 being the top row, going down to channel 3. The 4 rows below these are used for the sequence channels, to be explained in section 2.14. The currently active channel is highlighted in white, and is altered using 10 ↓ and 10 ↑.

The first item in each row is the name of the instrument selected – the channel currently in use has its instrument name highlighted. This is followed by an LED-style level indicator, which becomes active when a note is played. Coupled to this is a light-blue **fader control**, normally set at the rightmost (maximum) position. This control is explained in section 2.5.

The channel rows are arranged in 2 groups of 4, being separated by a scale with 15 divisions. This is the **level scale**, for use with the sliding fader controls. To change channels, push 10. The row will then change colour, and another channel can be selected using the ↑ and ↓ keys.

2.3.1 Noise Channel

Channel 0, the top row, is used to produce periodic or 'white' noise. Six different sounds are available on the following keys:

KEY	EFFECT
C	High frequency periodic noise
V	Medium frequency periodic noise
B	Low frequency periodic noise
N	High frequency 'white' noise
M	Medium frequency 'white' noise
,	Low frequency 'white' noise

Try the effect of these noises by pressing **f0 ↑** until the word **Beat** is highlighted in the noise channel. Pressing any of the above keys will produce the required noises, and these may be recorded in the same way as described in section 2.2.1 above.

2.4 Instrument Selection

f0 ← and **f0 →**

As discussed earlier, pressing **f0** together with **↑** or **↓** may be used to select a particular channel. The instrument to be played on that channel is selected using **f0** with **←** or **→**.

Any one of up to 32 instruments may be selected in this way, the first 16 being pre-defined in the program. For the remaining 16 undefined instruments, only the corresponding number is shown. Instruments can be set up, altered and renamed using screen 4, the **Instrument Definer**.

You may like to experiment with the 16 pre-defined instruments. Simply select the one of your choice using **f0 ←** and **f0 →**, then play the keyboard to hear the effect. You will hear that playing any given instrument on channel 0, the percussion channel, has a different effect to playing it on any of the other three.

2.5 Level Control

The volume of a note at any instant is displayed on the horizontal level indicator for each channel. This will alter as the note sounds, according to the amplitude envelope used in the current instrument definition. In addition to the automatic envelope control, the level can be altered manually while a note is sounding, by use of the fader.

2.5.1 Fader Position

f1 ← and **f1 →**

The current position of the manual fader is indicated by two light-blue dots on the level indicator. This will normally be at its maximum setting (at the end of the scale) but can be altered on the currently selected channel using **f1**. Hold down the **f1** key, then press **←** . The fader will travel down the level scale until **←** is released. Similarly, pressing **→** will increase the fader setting. Any note sounding on the current channel will decrease or increase in volume accordingly. Note that, due to limitations of the screen display, the fader cannot be set lower than a value of 2.

2.5.2 Fader Speed

f1 ↑ and **f1 ↓**

The fader control initially moves at an average speed, indicated by the value shown between channel rows 4 and 5. This can be altered by pressing **f1** together with **↑** or **↓** to increase or decrease the fader speed as required.

2.5.3 Recording

When the fader is operated during recording, the operation will be reproduced on playback for the channel in question. Note, however, that the fader rate is not affected by changes in playback speed (see section 2.10).

Channels may be balanced for the best results when recording. An existing recording may also be re-mixed as required.

2.5.4 Instant Level Change

If the fader position is altered before recording, and recording is then commenced at some point in the middle of a piece of music, Studio 8 will automatically insert a level change in the music. On playback, the fader will then jump to the new setting at the correct position in the recording. This techniques allows fast level changes to be made accurately.

After a fast-wind operation, the fader controls will again jump to the correct settings on playback, for the new position in the recording. The same applies after a cueing operation, as described below.

2.6 Cueing Markers

Although the fast-wind facility can be used to reach any position in a recording, an automatic cueing device is also included for added convenience. This allows an instant jump to any preset position.

The start and end points are already preset, but cue markers can be inserted at other locations, as described later. The marker name at the current position is displayed on the tape drive unit, below the operation indicator.

2.6.1 Automatic Cueing [12] [←]

Press **RETURN** to jump to the `Start` position. Pressing **12** together with **←** will now perform a jump to the first cue-marker. If no extra markers have been inserted, the name will change from `Start` to `*END*`, signifying the end of the recording.

When **12** is released, the position counter will change to the value for the new location. With no music in memory, this will be a value of `240`. Similarly, the previous cue-marker can be found by pressing **12** with **←**.

2.6.2 Marker Insertion [12] [COPY]

A new cue-marker can be inserted at any position in the recording by pressing **12** with **COPY**. This will cause the name `Cue 1` to appear on the tape drive unit, or `Cue 2` if there is a previous marker already set, and so on. Any number of cue-markers can be placed in a recording, wherever required.

As an example, press RETURN, then fast-forward to a counter position of about 10Ø. Press f2 COPY to insert the first cue marker. Wind on to 20Ø, and insert a second marker. Press RETURN to go back to the Start position. If you now press f2, a jump will be performed to Cue 1, then Cue 2, then *END*. f2 will jump backwards.

Now press RETURN then wind to a counter value of 5Ø. Inserting a new marker will make Cue 1 appear for the new position. Jumping to the subsequent markers will show that each has increased in value accordingly.

2.6.3 Marking Sections

The cue-marker information can help in identifying each section of a long recording. After inserting the markers as above, press RETURN and then fast-wind. The marker names will be displayed as they are encountered, until *END* is reached. This will also occur on playback.

Now rewind, and the previous marker names will reappear in reverse order. When playback is resumed, both the position counter and marker name will be at the correct setting.

2.6.4 Marker deletion f2 DELETE

Any preset marker name, except Start and *END*, can be deleted using f2 DELETE. To demonstrate this, fast-wind to a position showing the Cue 2 marker. Now press f2 DELETE, and this will be deleted, changing the name displayed to Cue 1. If f2 DELETE is pressed again, the first marker will also go, causing the Start name to reappear. Note that the position in the recording has not changed.

All subsequent markers will be automatically renumbered, so if a third marker name was present, this will now have become Cue 1. Notice that the notes-free indicator (middle of top row) will change as markers are inserted and deleted, as each marker occupies the space of one note.

2.7 Overall Volume f8 ↑ and f8 ↓

The volume level for all channels together can be controlled with this function, as with a normal volume control. The current setting is shown on the top banner of the display, above the volm label. This is initially set at 15 (full volume) and can be varied down to Ø (off), using f8 with ↑ and ↓.

Altering the overall volume does not affect the level indicators for each channel. Notice that the volume will alter while a note is actually sounding, in addition to the amplitude envelope effect.

2.8 Overall Tuning f4 ↑ and f4 ↓

This function allows the keyboard tuning to be altered, if Studio 8 is used to accompany other instruments or recordings. Alternatively, music may be 'transposed', to play back in a different key to that used when recording.

The parameter displayed in the top banner above the word `tune` signifies the tuning offset in quarter-semitones. This can be altered using **f4** with **↑** and **↓**. The offset may be as much as one octave in either direction (=48 quarter-semitones). It affects both the keyboard and playback of recorded music. For instance, a value of 3 will re-tune the notes to 3/4 semitone higher, while a value of -16 will transpose the music down by 4 semitones.

As with the other functions, the tuning value can be altered during playback, allowing its effect on the music to be judged instantly. The tuning will alter while a note is actually sounding, independently of the pitch envelope used.

2.9 Metronome Timer f5 ↑ and f5 ↓

Studio 8 has a built-in metronome. This only operates while the tape counter is running, and is actuated with with **f5 ↑** and **f5 ↓**. When **f5** is pressed you will see `time` light up in the top banner of the screen display. Pressing **f5 ↑** will cause the default value of `00` to increase in the sequence `01`, `02`, `04`, `16`, `32` etc. The metronome can be switched off by setting the value to zero. The actual beat rate depends upon the drive-rate set, as the two are synchronised together.

For convenience, regard the timer value as the number of ticks for every 'whole-note' period. A timer setting of 4, then, will tick 4 times in every whole-note, or once for each quarter-note. The duration of each whole-note depends on the drive-rate setting. See section 2.10.1 for more information on these points.

The metronome operates during record or playback, using channel 0 to produce the beat. When recorded music is played back, the metronome will always beat with the correct notes, whatever the playback speed. This gives accurate timing when dubbing over an existing recording.

2.10 Drive Rate f6 ↑ and f6 ↓

The drive-rate is also shown in the upper banner above the label `rate`, and may be altered with **f6 ↑** and **f6 ↓**. The default rate is `30`, but may be altered continuously from `10` to `99`.

Adjusting the drive-rate allows a recording to be slowed down when making alterations, or when recording a complicated passage. A faster speed can then be set for playback. The metronome rate will follow the drive-rate

setting, to maintain synchronisation with the music in the same way as a 'click track'.

2.10.1 Timing Relationship

Although the drive-rate value has no absolute meaning in itself, it is convenient to regard it as indicating the number of whole-notes played back per minute. On this basis, the position counter gives 1 count every quarter-note.

As an example, the default drive-rate is 30, indicating a playback speed of 30 whole-notes per minute, or 1 half-note per second. As the position counter gives 1 count every quarter-note, this equals 2 counts per second. A metronone timer setting of 4 will then give 30*4 = 120 beats per minute, or 2 beats per second. Note that when the timer is set to 4, the metronome will beat in time with the position counter, as both are working in quarter-notes.

When recording, the metronome can be set to any required speed by combination of the drive-rate and timer settings. The relationship between them becomes particularly important when recording accurately-timed sequences using the time-rounding option (section 2.14).

2.11 Recording

Select RECORD by pressing SHIFT L. The position counter will begin incrementing at 1 count per second, with the metronome in synchronisation.

The notes-free indicator (middle of top row) will decrement automatically when recording notes. If the memory becomes full, the message FULL will be displayed, and any further notes played will not be recorded. (See appendix C on how to obtain more notes-free space).

A complicated piece can be played in small sections, without having to learn a complete passage first. The main melody can be recorded on channel 1 (the second row down), then checked for the correct notes and timing. Any alterations can be made using the editing facilities (section 2.12). The bass line can then be added using channel 2 or 3, leaving one tone channel for chords, and harmonising with the melody and bass line.

2.12 Editing Facilities

Existing music can be edited at any time by deleting and inserting notes, and altering instruments while the music is playing. The following instructions can be followed after recording a few notes into memory.

2.12.1 Deleting Notes DELETE

When the DELETE key is pressed during playback, the DL indicator on the tape drive unit will light up, and notes on the currently selected channel will be deleted as they play, until the key is released. The notes-free indicator will increment automatically when deleting, due to the extra space made available by the deleted notes. Any level changes recorded on the current channel will also be deleted as they occur.

2.12.2 Altering Instruments COPY

If COPY is pressed during playback, the CP indicator on the tape drive unit will light up, and the instrument setting on the current channel will be copied into the recording as the notes sound. This process will continue for all notes on the same channel, until the COPY key is released.

As an example, after recording some notes using `Piano2`, select the `Vibra1` instrument with 10 ←. Now play back the recorded music, pressing COPY as the notes sound. The new instrument will be copied into the music data, for the currently selected channel. In this case, the affected notes will be given a vibrato effect.

Other instruments can be selected and copied into other notes, and this can be repeated as often as necessary. By selecting another channel, the notes sounding on that channel can be altered in the same way.

2.13 Sequencing

The idea of **multi-level sequences** is introduced here. So far, only the top 4 rows on the mixing console have been dealt with. The bottom rows are the 4 **sequence channels**, each of which operates as a playback unit for a complete recording, rather than producing a single note. All 4 of these sequence channels can operate at once with different recordings, giving great flexibility.

2.13.1 Playing Sequences

Select one of the sequence channels using 10 ↑ and 10 ↓ as explained in section 2.3. The name shown in the instrument box is not an instrument name, but the name of a sequence which can be played back as and when required. Different names can be selected in the same way as with the instruments, and a selection of sequences has been included for your own use.

First select the fifth channel (which contains the default sequence `Flange`) using 10 ↑ and 10 ↓. Then, using 10 ←, select the sequence called `Loop`. When this has been found, release 10. This sequence can be played back, not by using the cursor keys, but by pressing a music key as you would for a

single note. Press a key on the QWERTY keyboard, and you will hear the sequence play as a simple loop of 4 notes. Now press another note, and it will play again, but in a different key. The sequence takes its 'base pitch' from the key that is pressed, and operates through the entire 6-octave range. Now press SPACE, and the sequence will stop.

2.13.2 Level Indicators

You will have noticed that, while the loop was playing, the level indicator on the sequence channel functions as the notes sound, but channel 1 also operates, in yellow. This is because the sequence is using channel 1 in the recording, the yellow indicator showing that the channel is being used, not directly, but via the sequence. This is useful when editing a recording composed of sequences, to identify the channels used.

2.13.3 Sequence Effects

The single-channel loop just described is only one kind of sequence. To try another, select the `Chorus` sequence in the same way, and play it by pressing a music key. This time only one note sounds, but using all 3 tone channels. This sequence can be used as an automatic chord facility. Other similar types are `Major5` and `Minor5` (major and minor 5th chords) and `Flange`, which creates a flanging effect by using the same frequency on 2 channels together.

Browsing through the selections will reveal other types of sequences, including `Rythm1` and `Rythm2`, two auto-percussion effects. The `TremLo` sequence does not produce any sound, but manipulates the fader control on channel 1, again in a loop. This gives a tremolo effect when notes are played on channel 1, either directly or via another sequence. Again, the action will stop when SPACE is pressed.

2.13.4 Parallel Sequences

As there are 4 sequence channels available, up to 4 sequences can be played together at the same time. To demonstrate this, select `Rythm2` on the first sequence channel, and begin the sequence by pressing a music key. Now move to the second sequence channel and select `Flange`. Notes can be played using the flange effect while the rhythm sequence is functioning. The same applies to any other sequence available.

Parallel sequences can also share the same channel. While `Rythm2` is playing, select `Rythm1` on another sequence channel, and press a music key. The 2 sequences are now both playing on the noise channel. With careful timing, interesting effects can be produced. Terminate the sequences using SPACE, or just push ↓ or RETURN.

2.13.5 Volume Level f1 and f1

Each sequence channel has its own fader control operated in the same way as the sound channels with f1 and f1. When this is used, all channels used by the sequence will change volume, although their level indicators will not be affected. This gives a similar effect to the overall volume control, but only for the channels used by the sequence.

2.13.6 Playback Speed

The speed of the sequences is affected by the drive rate as normal. Consequently, sequences playing in conjunction with a recording will remain in synchronisation with the recorded music. All the looping sequences provided have been produced with the same timing, to allow them to be used together if required. `Rythm2` and `Loop` are examples.

2.13.7 Sequences in Recordings

When using a sequence in a recording, only one note is used up each time the sequence is begun, however complex it may be. This gives a much larger effective capacity for music than the notes-free indicator would suggest, as sequences could be used to repeat passages which occur frequently in a piece of music. Looping sequences can also be used to save memory. (See appendix C on how to save even more memory).

Bear in mind that a sequence will only be recorded if the music key is pressed when recording is in progress. If the key is pressed beforehand and recording is then begun, the sequence can continue to play without being present in the current recording. Also, ensure that a looping sequence is terminated with SPACE at the required place in a recording. Otherwise, the loop will continue to the end of the recording when it is played back.

A sequence can be deleted in the same way as a single note, by pressing DELETE when the sequence is about to start. Sequences can similarly be substituted for another on playback by pressing COPY. The procedure is explained in section 2.12.

2.13.8 Recording your own Sequences f7

If you have recorded any music using the tape drive, then you have already produced a sequence. Whenever music is recorded in memory, it can be given a name and used with the sequence channels. The music memory is divided up into 32 sections, each of variable length, to give 32 separate recordings for use as sequences.

To select one of these sections for recording, push f7. The function window will change to display an `EDITING SEQUENCE` frame. This allows you to choose a sequence for editing or recording, and initially shows the name `Master` in the centre of the window. This is the sequence you are currently using, and is normally reserved for producing the final master recording.

Hold down the ← key until the Flange sequence is reached. Now push RETURN to resume normal operation. If ↑ is now pressed, you will find that the tape drive plays back the Flange effect as a normal recording.

Push f7 again, and tap ← until you reach the first unnamed sequence, **1**. Now type TEST 1 to give the sequence a name. The DELETE and COPY keys can be used to move the cursor left and right. Push RETURN and you are ready to record the sequence.

Press TAB until the value 03 is shown on the keyboard unit (to set the octave), then select channel 1 and set record using SHIFT 1. Now record 3 notes using QWERTY keys S, I and U, then push RETURN. This has now become a simple 3-note sequence. Test this by selecting a sequence channel, and using f0 to find the TEST 1 name. When found, press a music key. After a short delay, the 3 notes will play back on channel 1 as a normal sequence. Section 2.14.2 will explain how to eliminate the delay, to allow the sequence to start instantly.

After returning to the Master sequence using f7 followed by ←, the new TEST 1 sequence can be used in another recording.

2.13.9 Base Key

When a sequence is played using a key of C in octave 4, the sequence will play back in its original key. Keys other than this 'base key' will transpose the sequence accordingly.

It is important to ensure that sequences are recorded close to the middle of the range of octaves, hence the setting of 03 in the earlier example. This enables the sequence to be used throughout the keyboard range. If recorded in a low octave, the sequence may not be audible when played using a low music key, or may 'wrap-around' to a very high frequency in extreme cases. Similarly with a high octave.

2.13.10 Multi-level Sequences

Although channel 1 was used in the above example, a sequence channel could equally well have been used. For instance, choosing the bottom sequence channel row with the Echo effect would produce a sequence consisting of another sequence. Furthermore, sequences on various channels may be combined into a new sequence, as long as one sequence channel is left free. The free channel will then be needed to play the final 'composite' sequence later on.

Care should be taken when choosing channels, to avoid clashes occurring. If a sequence calls another sequence on the same channel, the second one will take over from the first, cutting the original sequence short. When playing multi-level sequences, make sure the sequence is used on a channel that will remain free when it plays back. For instance, select the bottom channel rows

for sequences used within a sequence, and the top row for playing the final sequence afterwards.

2.13.11 Further Uses

The examples provided give straightforward applications of sequences for automatic chords, auto-percussion, flanging, tremolo, echo and simple loops. As indicated in the previous sections, much more complex effects can be built up by combining sequences together to form a new sequence.

The size of a sequence is limited only by the amount of memory available, allowing any sequence to consist of hundreds of notes, if required. A collection of separate recordings could be made, each defined as an individual sequence, to give a music 'album' on a single file.

The majority of compositions contain passages which are repeated at various places in the music. These can be recorded separately as sequences and called up when required, thereby reducing memory usage and avoiding re-playing similar sections. The fader controls may be used to vary the level each time, and extra parts may be improvised over the repeated passages.

2.14 Sequence Options

Pressing **F6** will present various options in the function window, for use when producing sequences. The purpose of each of these is explained below.

2.14.1 Time Rounding **F8** **10**

When recording music from the keyboard, it may be difficult to ensure perfect timing of each note, even when recording slowly. This is particularly important for loops and percussion sequences. The time-rounding function causes notes to correspond to the metronome ticks, or the midpoint between ticks.

To set `time-rounding`, select the options with **F8**, then push **10**. The symbol `TR` will appear above the metronome timer value. Now set the metronome to Ø4 or Ø8, and record a few notes. On playback, notes will sound in time with the metronome – either on a tick, or midway between ticks. The metronome may be switched off after recording, without affecting playback.

The lower the metronome setting, the more pronounced will be the time-rounding effect, while a setting of 0 will produce no time-rounding. The required tempo can be selected by using a combination of the timer value and drive rate.

A further advantage of this function is that recorded music can be made to keep exact time with other sequences, allowing them to retain

synchronisation when used in parallel. `Loop`, `Rythm1` and `Rythm2` are examples of this.

2.14.2 Instant Start [f8] [f1]

After recording a sequence as explained in section 2.13.8, there was a delay between pressing a music key and hearing the sequence. This is because the first note was not recorded at the very beginning of the sequence. This can be corrected with the `instant start` option.

After recording a sequence, enter the options with [f8], then select `instant start` with [f1]. When the recording is subsequently played back using the tape drive or a sequence channel, it will begin immediately.

The instant start facility will normally be needed when setting a looping sequence, explained in the next section. This should be set before the looping option, to ensure that the loop occurs at the correct time. This is because the loop event is always time-rounded, whereas the first note may not be.

When a sequence is being recorded, an instant level change is automatically inserted for each channel used, as explained in section 2.5.4. To ensure the fastest possible 'instant start', you may wish to delete these level changes using the text editor page, if they are not required. This would not normally be necessary, particularly if only 1 or 2 channels are used in a sequence, but may be preferable for applications such as 3-note chords, where an immediate response is essential.

2.14.3 Looping [f8] [f2] and [f8] [f1]

Any sequence can be made to perform a continuous loop if required. This is done by selecting [f2] (`Set Looping`), after pressing [f8] for the options. The function window will ask you to select the looping position, using the normal drive controls for fast-wind, playback, stop and return.

When at the required position in the sequence, push [SPACE] to set the loop. On playback, the sequence will then start again automatically each time the selected position is reached. An existing sequence can be made to loop after recording, or notes can be recorded while a sequence is looping. Note that the loop can only be set at a position after the last note in a sequence.

An important point is that the looping event is *always* time-rounded to a metronome tick, whether or not the time-rounding option is set. With the metronome set on 4, the loop will always correspond to one of the beats. It is advisable to set the metronome to this value before setting a loop, to ensure the timing is as expected.

This time-rounding ensures that looping sequences can be synchronised together, and is necessary for the fast-wind operations to work properly, when loops are used in a recording. The looping effect can be cancelled using [f8] followed by [f1]. The sequence will then stop when the end is reached, as normal.

3. MUSIC EDITOR

3.1 Introduction

The Music Editor is accessed by pressing CTRL f1. The Editor displays the current sequence in a straightforward command language, to allow precise editing of recorded notes. Music data can also be entered directly in text format, without playing music in real-time. Notes can be entered in a combination of real-time and text input, by alternating between the **Studio** and **Editor pages**.

The majority of the display is used for the sequence text, each note occupying one line (see figure 4). Note details are given in six columns, with headings shown above the text area. These will be explained in the next section. In addition to this, the far-right columns show the tape counter value for each note, while the left-hand area is used for `Start`, `End` and `Cue` labels.

As in the **Studio page**, the number of notes free is constantly displayed in the middle of the top banner. To the left is shown the name of the currently selected sequence, with its time signature on the right. This is explained in section 3.6.

Figure 4

The music text can be scrolled using the ↑ and ↓ cursor keys, to allow a long sequence to be inspected. A flashing cursor indicates the current note being edited, on the middle line of the display.

3.2 Command Syntax

There are six data items, or 'fields', making up each note. These are shown above the columns as `Key`, `Chan`, `Bar`, `Beat`, `Dur`, and `Ins`.

3.2.1 Key value

The `Key` field consists of 3 characters, comprising the octave number (0 to 7), key symbol (A to G) and a '#' character to indicate sharps. If the data line signifies a level change rather than a note, the letter L is shown in yellow in place of the key value.

3.2.2 Channel

`Chan` shows the channel number used for the note. This will be 0 for the noise channel, 1 to 3 for the note channels and 4 to 7 for sequences.

3.2.3 Bar and Beat

These two settings together signify the time value for the note. The Music Editor divides the time values into bars, as in music notation. The length of the bars, and range of beat values within each bar, is determined by the time signature setting, to be explained later.

The `Bar` value allows easy identification of note positions in a sequence, by dividing the values up into groups of a fixed duration. With a normal playback speed of 30, the duration of each bar is equal to twice the time signature, in seconds.

TIME SIG	LENGTH OF BAR
3/4	1.5 seconds
4/8	1 second
4/2	4 seconds

The `Beat` value indicates the timing of a note within a given bar. This value counts in steps of 4 for each beat (0, 4, 8 etc) allowing other notes to be inserted between these beats. As these fields display 3 digits, the `Bar` and `Beat` values can reach a maximum of 999, and will then recycle back to 0. They will be explained further in section 3.3.

3.2.4 Duration

The `Dur` field indicates the duration of each note in beat values, for notes recorded with manual sustain. For auto-sustain, the letter A is displayed in

place of a numeric value. If the text line refers to a level change, this section will show the fader speed (1 to 20) in yellow, preceded by the letter S. An instant change (section 2.5.4) has a speed value of 0.

3.2.5 Instrument

`Ins` shows the instrument or sequence number used for recording the note, ranging in value from 1 to 32. The actual instrument used depends upon the instrument file currently loaded, as these can be altered for existing sequences.

For a level change, this field shows the target level (from 2 to 15), preceded by a T.

3.3 Text Entry ↑ ↓ ← →

Note details can be entered from the keyboard to specify the parameters outlined above. To create a blank line for entering the note, press RETURN. The values can then be typed in for each field. The flashing cursor indicates the current position, and can be moved using the ← → keys. When the line has been entered, pressing RETURN, ↑ or ↓ will enter the note in the music. Any fields left blank will assume a default value, as given below:

Field	KEY	CHAN	BAR	BEAT	DUR	INS
Default	4C	1	[last val]		A	1

If RETURN is pressed, another blank line will appear, ready for the next note to be entered.

3.3.1 Level changes

If an `L` is entered for a key value, this signifies a level change for the specified channel. The `Dur` and `Ins` fields will then be used for fader speed and target level values, as explained earlier. In this case, the default values are:

Field	DUR	INS
Default	S10	T15

3.4 Editing Facilities DELETE and COPY

Notes already present in the text can be altered in various ways, or deleted individually. After using the cursor keys to position the cursor at the required item, entering digits will overwrite the previous value.

The DELETE and COPY keys will move the cursor left and right within the chosen field, for altering single digits. SPACE can be used to erase any

digits. For example, to change a key value from sharp to natural, position the cursor over the # symbol in the first field, and push SPACE to erase it.

Individual notes can be deleted by pressing SHIFT DELETE. The current text line will disappear, and all subsequent notes will move up one line. As the DELETE key auto-repeats, holding the keys down will delete further notes, until they are released.

3.5 Preview TAB

Pressing the TAB key allows the current note to be sounded. For a newly-entered note, any blank fields will assume their default values (section 3.3) for the purpose of sounding the note. The preview facility applies to single notes, sequences and level changes.

3.6 Time Signature

The time signature, or metric signature, is displayed at the top right of the Editor screen. It is used as a guide to indicate the overall rhythm (metre) of a piece of music. The first number indicates how many beats there are in each bar, and the second number gives the value of each beat (quarter-note, half-note etc). For example:

3/4 indicates 3 quarter-notes per bar
4/2 indicates 4 half-notes per bar

3.6.1 Settings [0]

Time signature settings can be entered independently for each sequence, to suit the type of music recorded. The time signature for all sequences is initially set at 4/4 time (Common Time) as this is the most often used setting. 2/4, 3/4 and 6/8 time are also popular, and one or more of these settings will be found suitable for almost all types of music. However, Studio 8 will allow you to select time signatures with any combination from 1/64 to 64/1 time, for maximum versatility.

The time signature is set by pressing [0]. The text window will then display the necessary prompts, allowing you to change the values using the ↑ ↓ cursor keys.

A time signature of 4/4 does not mean that the music in each bar must consist of 4 quarter-notes. Other note values can be used in any combination, provided they add up to a value of 4 quarter-notes (or 1 whole note) for each bar.

3.6.2 Bar/Beat Values

The Music Editor will display the `Bar` and `Beat` values appropriate to the current time signature, for any given recording. The time signature does not alter the music itself, only the display of `Bar` and `Beat` values in the Editor – altering the time signature will cause these values to change, without affecting the actual recording. You should choose the time signature that gives the most convenient range of `Bar` and `Beat` values for the music recorded – 3/4 and 4/4 time will normally be suitable.

For more accurate **Beat** values, 6/8 or 12/16 time can be used instead of 3/4, and similarly for 4/4 time. Bar values will remain the same, (12 sixteenth-notes is the same duration as 3 quarter-notes), but the Beat values will be doubled or quadrupled. This will enable fine timing adjustments to be made to notes, that would not show up with a normal time signature.

3.6.3 Music Score Entry

If the Music Editor is being used to enter notes directly from a music score, set the time signature to that shown at the beginning of the music. When entering the notes, you will need to work out the Bar and Beat values from the music notation.

All notes in the first bar will have a `Bar` value of **0**, progressing to 1, 2 etc. for each new bar. The `Beat` value gives the number of beats between the start of the bar and the current note. This counts in steps of 4 for each note unit (quarter-notes for 3/4 and 4/4 time). If all the notes were quarter-notes, then the timing values would be as follows:

4/4 time	BAR	BEAT	3/4 time	BAR	BEAT
	0	0		0	0
	0	4		0	4
	0	8		0	8
	0	12		1	0
	1	0		1	4
	1	4		1	8
	1	8		2	0
	1	12		2	4
	etc.			etc.	

In practice, various combinations from whole-notes to sixteenth-notes will often be used. A Beat value of 1 indicates a sixteenth-note, so each Beat value gives the number of sixteenth-note beats up to the current note. Remember that `Beat` is not concerned with the duration of the note, only the timing of the note within the current bar. The `Dur` value (section 3.2.4) is used to specify the note duration, and this also works in Beat values.

3.7 Time Offset [f]

The time offset function alters the timing of all notes from the current position onwards, rather than just the current note. This can be useful for

creating space to insert an extra passage in a sequence, or to alter the delay before the music begins.

Pressing **f1** will allow you to enter the time value for the current note, as explained in section 3.3.2. When **RETURN** is pressed, the timing of all subsequent notes will alter accordingly.

3.8 Sequence Functions **f7** **f8** **f9**

The sequence functions provided in the Studio page by **f7** to **f9** are also available in the Music Editor. These provide sequence selection, instant start, looping and erasing, which were dealt with in sections 2.13 and 2.14. They all operate as before, but the looping function **f8** is easier to use, as the loop timing is entered separately, using the editing facilities. The time-rounding option is not applicable in the Music Editor, so this has been replaced by a printout function.

3.8.1 Text printout **f8** **f0**

A facility is provided to allow an entire sequence as displayed in the Editor to be output to a printer. The printout follows the same format as the display screen itself, with the tape counter values in the last column of the listing. The printout option is selected by pressing **f8** followed by **f0**, and can be cancelled at any time using the **ESCAPE** key.

4. ENVELOPE EDITOR

4.1 Introduction

The **Envelope Editor** is entered by pressing **CTRL F2** from any of Studio 8's six control screens. When this selection is made, you will see the Envelope Editor control screen with its `Amplitude` and `Pitch` windows in the upper half of the screen (see figure 5).

Above these two windows is a banner displaying the envelope numbers and step-length values used in the instrument that is currently selected. These are shown above the `env` and `len` labels, for the amplitude and pitch envelopes.

As with the Studio page, the keyboard display is again shown, and the QWERTY keyboard may be played as normal. This allows the effect of envelope changes to be heard immediately, and in any key. As a note plays, pointers appear next to each envelope window, to indicate the section currently active. As the split-keyboard option (section 6.5) is not relevant to the Envelope Editor, it cannot be set in this page.

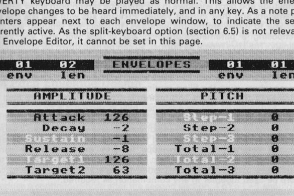


Figure 5

4.2 Preset Envelopes

Studio 8 is capable of storing 16 amplitude and pitch envelopes, accessed by number in the Envelope Editor and Instrument Definer. These are preset in the program, but can be re-defined or modified using the Envelope Editor. The resulting envelopes are then combined to form various instruments, using the Instrument Definer page covered in section 5.

Bear in mind that any alterations made to an envelope will alter the sound of *all* the instruments that make use of it. This will in turn affect sequences using these instruments, and finally any recorded music incorporating those sequences! The Envelope Editor should therefore be used only when a specific change is required for *all* instruments using a given envelope, or to re-define an envelope not currently being used by any instrument.

4.3 Altering Parameters

The amplitude and pitch windows in the Envelope screen both show a list of six parameters and their current values. Pressing with enables you to move around the windows, to select the required section. After choosing a parameter, pressing or will alter the value accordingly. The keys repeat as normal, so can be held down for continuous operation.

The resulting envelopes will be saved along with data for instruments and sequences when using the filing routine to save music data to cassette or disc. However, the envelope and instrument values alone can be filed in directory `I`, if required. This is explained fully in section 7.3.2.

Studio 8 contains its own software to directly access the BBC micro's sound generator chip so as to avoid some of the pitfalls of the BBC's `SOUND` and `ENVELOPE` commands. The envelope features used follow the same general format as those in BBC Basic, although to improve flexibility, the amplitude and pitch sections are treated as separate envelopes, and can therefore be used together in any combination as required.

4.3.1 Parameter Functions

The parameters for each envelope are summarised below:

PARAMETER	FUNCTION	RANGE
`Attack`	Amplitude attack to Target1	−128 to 127
`Decay`	Amplitude decay to Target2	−128 to 127
`Sustain`	Amplitude sustain towards 0	−127 to 0
`Release`	Amplitude release towards 0	−127 to 0
`Target1`	Amplitude level for attack	0 to 126
`Target2`	Amplitude level for decay	0 to 126

`Step1`	Pitch change per step (1)	−128 to 127
`Step2`	Pitch change per step (2)	−128 to 127
`Step3`	Pitch change per step (3)	−128 to 127
`Total1`	Number of pitch steps (1)	0 to 255
`Total2`	Number of pitch steps (2)	0 to 255
`Total3`	Number of pitch steps (3)	0 to 255

4.3.2 Envelope Editing F1 F2 F3 F4

The best way to get used to these parameters and their effects is to enter the Envelope Editor and try out a few values. The pre-defined envelopes provide a useful starting point from which to experiment.

As an aid, the envelope being edited can be slowed down for analysis, by increasing the step-length values (use F4). These are shown in the top banner, above the `len` labels, and are independently adjustable for the amplitude and pitch envelopes. Together with the pointer display, the action of each envelope can be clearly shown. This is particularly useful when editing a complicated pitch envelope.

It is important to remember that altering the values shown on the top row of the display will not affect the instruments themselves in any way. They are for use within the Envelope Editor only. The **Instrument Definer** page is used to form envelope combinations for selected instruments.

4.4 Pitch Envelope Design

Care should be taken with the pitch envelopes to ensure that notes remain in tune, as results can be difficult to predict. The Envelope Editor allows you to experiment with sets of values, and listen to the results as changes are made. The most important consideration is that the overall pitch of the envelope should correspond to the key pressed, or music will sound out of tune.

The pitch envelopes will automatically repeat, so that the first section will begin again when the third section has finished. To force the envelope to produce a continuous note after the second section, `Total-1` should be set to 255, with `Step-3` set to 0. Envelopes 13 and 14 are both set up in this way.

4.5 Amplitude Envelope Design

Despite the more complicated four section 'ADSR' (ie Attack, Decay, Sustain, Release) principle of the amplitude envelope, the effect is easier to predict than for pitch envelopes. The main consideration is to ensure that the `Attack` and `Decay` sections correspond sensibly to the target levels. For instance, the `Decay` parameter, though usually negative, can be positive if desired, giving an extra delayed attack. This will only operate correctly if

`Target2` is larger than `Target1`. It is also possible to set a negative `Attack`, but the results can be unpredictable.

Of the two target levels, the largest should always have the maximum value of 126. The volume settings can then reduce this if required, when the envelopes are being used to define instruments, and when using fader controls in the Studio page.

The `Sustain` parameter normally has a value of 0 but it is possible to set a negative value. This effectively gives two Release phases – the negative Sustain and normal Release.

The `Release` section will operate after a specified period, set in the Instrument Definer page for each instrument used. Alternatively, release can be performed on demand by pressing **SPACE**, or releasing the music key when the manual-sustain option is set (section 6.4).

5. INSTRUMENT DEFINER

5.1 Introduction

The 16 amplitude and pitch envelopes provided in Studio 8 are not used directly in music, but are combined with each other to produce 32 named instruments. This is the purpose of the `Instrument Definer` page, accessed using **CTRL 6** from any Studio 8 screen.

The currently selected instrument is shown on the left side of the top banner of the Definer screen, with its associated number on the right. The central area displays the 6 different parts of the instrument definition, with their current settings. These are selected and altered using keys **f1** to **f6**.

You should note that although the keyboard can be used to play notes as normal, the split-keyboard option does not function in this page.

5.2 Preset Instruments **f0 -** and **f0 =**

16 of the 32 instruments have been pre-defined in Studio 8, as examples of some of the effects available. These are detailed in appendix D, but can be



Figure 6

modified or re-defined in the Instrument Definer, to your own requirements. The remaining 16 are undefined, each name consisting of the instrument number within asterisks.

To select an instrument for defining, press **10**. The function window will change to display the name of the current instrument. Tapping **←** or **→** will then step through the names, as when instruments are selected in the Studio page. Any name can be altered by typing on the QWERTY keyboard, **DELETE** and **COPY** enabling the cursor to be moved left and right.

When the required instrument has been found, pressing **RETURN** will select that instrument, and the parameters will appear on the central area of the display.

5.3 Envelope Combinations **f1** **f2** **f3** **f4**

The first 4 parameters displayed are the amplitude and pitch envelope selections, together with step-length values for each. These determine the length of each step of the envelopes, in 1/100th-second intervals. The larger the step-length, the slower the associated envelope will execute. Any of these settings can be altered by pressing **f1** to **f4**, together with **↑** or **↓**.

These functions enable the amplitude and pitch envelopes to be selected separately, with independent step values for each envelope. 256 envelope combinations are possible, with the step-length values greatly extending the number of affects which may be achieved without re-defining envelopes in the Envelope Editor.

5.4 Volume Level **f5** **↑** and **f5** **↓**

Some amplitude envelopes sound louder than others, due to the sustain level (`target2`) being higher. Amplitude envelopes 7 to 11 are examples of this. To compensate for differences in overall volume, a `volume level` setting is provided for the instrument definition. The value is altered by pressing **f5** with **↑** or **↓**.

This modifies the amplitude between 0 (off) and 15 (full volume), and operates in addition to the overall volume and fader controls in the Studio page. For maximum level range, this value is normally set to 15, but `0rgan1` and `0rgan2` are set slightly lower.

5.5 Sustain Time **f6** **↑** and **f6** **↓**

When the manual-sustain option is switched off, notes will be sustained for a given time period before the release phase is automatically performed. This

period is set by the `sustain time` in the instrument definition. The value is specified in 1/20th-second steps, and is altered using **16** with **↑** **↓**.

Some instruments, such as `Piano1` require a long sustain period for the note to fade slowly, while `Beat` and `Blip` only need a short sustain. The maximum value allowed is 200, giving a sustain time of 10 seconds.

6. KEYBOARD SETTINGS

6.1 Introduction

The **Keyboard Settings** page is accessed by pressing **CTRL f4** from any screen within Studio 8. This provides facilities for selecting between different types of add-on keyboard, and full control of the split-keyboard and polyphonic functions, and other controls to give the keyboard various characteristics. These settings are then carried over to the other pages, for use with real-time music input. Most of the functions are applicable to the QWERTY keyboard, but the add-on keyboard will take maximum advantage of the facilities.

Although the QWERTY keyboard functions for music input in this page, the keyboard display is replaced by an area showing the polyphonic channels set, and indicators for the 3 keyboard options (see figure 7). These are equivalent to the **M**, **S** and **P** indicators mentioned in section 1.6.3, and will be fully explained later.

The middle of the Keyboard screen is occupied by the split-keyboard settings, showing full information on the values set for each octave. These only apply when the split-keyboard option is set, to be explained in section 6.5. This also displays an octave indicator, equivalent to the note indicator on

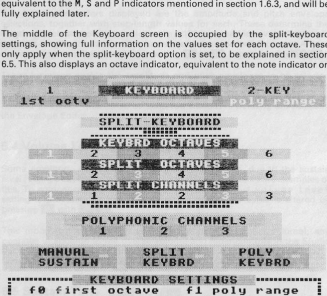


Figure 7

the normal keyboard display. The octaves set for the QWERTY keyboard (altered with TAB) are highlighted on this row.

The top banner displays settings applicable to the add-on keyboard, for the first octave value and polyphonic range.

6.2 First Octave f0 ↑ and f0 ↓

This is displayed on the left of the top banner of the Keyboard screen, and is controlled by f0 ↑ and f0 ↓. This setting does not affect the QWERTY keyboard, but is used to extend the range of the add-on music keyboard, if fitted.

As the value is increased, the keyboard range is shifted up 1 octave. With a value of 3, a 4-octave keyboard will actually play octaves 3, 4, 5 and 6. It is important to distinguish between physical keyboard octaves and the actual octaves played, particularly when using the split-keyboard option. This refers to the physical octaves, so the `first octave` setting will not affect its operation. The octave indicator on the split-keyboard display also shows the physical octave being used.

6.3 Polyphonic Range f1 ↑ and f1 ↓

A maximum of only 2 notes can normally be played simultaneously on the QWERTY and add-on music keyboards. If a third key is pressed, this will not register until one of the other keys is released. This is the meaning of the `2-KEY` setting on the right side of the top row.

To allow 3 or more keys to register at the same time, the `poly range` setting can be changed to `FULL`, using f1 ↑. Now all keys will function on the QWERTY and music keyboards, however many are held down. As the BBC micro's QWERTY keyboard is only designed for 2-key rollover, extra unwanted notes will be generated for some key combinations (eg. E, F and T). This can also happen with the add-on keyboard, but the construction details (see appendix E) explain how to overcome the problem.

The full polyphonic range setting is of most use with the add-on keyboard, when combined with the polyphonic keyboard option, explained in section 6.6.

6.4 Manual Sustain f5

When a music key is pressed, the note normally sounds for a fixed duration, depending on the instrument setting used. This is automatic sustain. If manual sustain is selected, the note will perform the release stage as soon as the key is released.

Manual sustain can give more natural operation with some instruments, and a greater degree of control. When recording with this option, the sustain period for each note will be reproduced exactly on playback. Selection is made using f5, or SHIFT RETURN as in the other pages.

6.5 Split Keyboard f2 / f3 / f6

Normally, the currently selected channel is used for all notes played at the keyboard. When the split-keyboard option is selected, the channel used will depend on which octave is played. This option is set by pressing f6 or SHIFT DELETE, and the channel/octave relationship is shown in the central area of the display.

The keyboard is split into 6 sections, one for each physical octave. These are shown under the KEYBRD OCTAVES title. The actual octave sounded in each section is shown on the next row. Each value can be changed using f2 with ← → after selecting the required section using f2 with ← →. Similarly, the channel used for each section is shown on the lower row, and can be changed using f3 with ← → ← →.

In this way, each section of the QWERTY or add-on keyboards can use a different selected instrument or sequence on any channel, in any octave. This effectively forms 6 separate instruments, all available at once. The default settings are:

Keyboard octave	1	2	3	4	5	6
Actual octave	1	2	3	4	5	6
Channel	1	1	2	2	3	3

As a demonstration, select the split-keyboard option, and return to the Studio page for the moment. Now select Piano1, Piano2 and Piano3 on channels 1, 2 and 3 respectively. Now play the keyboard, and the character of the note will depend on which octaves are played. With the QWERTY keyboard, different channels will be selected when changing octaves with TAB. Using an add-on keyboard, low and high octaves can be played simultaneously with both hands, each in the appropriate instrument.

6.6 Polyphonic Operation f7

As mentioned in section 6.3, in the default state, when two or more keys are pressed at once when playing notes, only one channel is used to play them. This means that each note cuts off the previous one, so that chords cannot be played. When the polyphonic option is set using f7 or SHIFT COPY, all 3 tone channels can be used together, making 2 or 3-note chords possible. This will only function when a tone channel is selected, not a sequence or noise channel.

Combining manual-sustain with the polyphonic option can be very useful, allowing the keyboard to handle more naturally, in a similar way to a piano. This is particularly suited to the add-on music keyboard.

Although all 3 tone channels sound the notes, they will each use the instrument that is selected on the current channel. This becomes more complicated if the split-keyboard option is also set, when the instrument will then depend on the octave played.

6.6.1 Polyphonic channels [f4] [1] and [f4] [!]

If only 2-note chords are required, one of the channels can be bypassed using the Polyphonic Channels setting. [f4] is used with [←] / [→] to select the channel, which can be removed or restored using [f4] with [!] [1]. In this way, any selected channel can be reserved for another part, with no interference from the polyphonic setting.

6.7 Add-on Keyboards

Studio 8 will accept one of two types of add-on keyboards. Both plug into the User Port underneath the front of the BBC micro's keyboard. When in use, both the add-on keyboard and the QWERTY keyboard can be played together.

6.7.1 Types of Add-on Keyboard

Studio 8 will work with two different types of add-on keyboard:

1. ATPL Symphony and related keyboards
2. Self-built Studio 8 keyboard

To obtain full construction details of the self-built keyboard see appendix E.

6.7.2 Add-on Keyboard Type Selection [f8]

Studio 8 must be informed if you wish to change between types of add-on keyboard. To do this, select the `kbd` option by pressing [f8].

After pressing [f8], the current type of add-on keyboard that can be used with Studio 8 is displayed, along with the option to change to the alternate type.

7. FILE CONTROL SCREEN

7.1 Introduction f0 and f1

The **File Control** page is concerned with saving and loading all Studio 8 files. Star commands may also be issued from this page. The page is accessed from anywhere in the package by pressing CTRL f5.

The top banner of the File Control screen (see figure 8) displays general information on the filing system in use, changing as different file options are selected. The middle section consists of a text window displaying commands, prompts and error messages. f0 and f1 may be used to load and save files, as indicated in the function window.

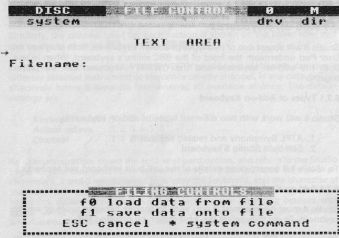


Figure 8

7.2 System Commands *

In addition to the load and save options, any BBC micro star command may be issued from this page. For example, you may wish to change filing systems (by typing *TAPE or *DISC etc), or to change drives with the *DRIVE command, etc. However, care should be taken with the DFS commands, as some require memory space to operate, and can destroy both

program and data. These include *COMPACT, *BACKUP and *COPY. Consult your DFS manual for more information.

7.3 File Types

7.3.1 Music Files

When using the disc filing system, directory **M** is automatically selected on entering the File Control page. This is the default directory for music files, but may be altered if required using *DIR. The current setting is displayed on the banner at the top of the screen, together with the drive number. When a music file is saved, information on all currently assigned envelopes, instruments and sequences will also be saved.

7.3.2 Instrument Files

On the disc system, directory 'I' is reserved for instrument and envelope details only. If this directory is selected, the message INSTRUMENTS will be displayed when a file is saved. When using tape, preceding the filename by 'I.' will perform the same function.

If directory 'I' is selected when files are saved, all music data will be retained in memory, but only the instrument and envelope details will be saved. In this way, a separate instrument library can be produced in directory 'I', tailored to your precise requirements. When an instrument file is subsequently reloaded, an existing recording will not be disturbed; only the instruments and envelopes will be altered.

You may wish to save to cassette or disc the default settings provided in Studio 8 by saving them as an instrument file. If parameters are subsequently altered using the Envelope Editor or Instrument Definer, the original data can easily be restored afterwards by reloading this file.

7.4 Studio Settings

Ensure that all settings on the Studio screen are as required before saving music with the filing routine. The following settings will be saved: Instrument and sequence selections for each channel, drive rate setting and tuning value.

In the case of instrument files, only the instrument selections will be restored. All other settings will remain unaltered.

7.5 Emergency File Option ESCAPE BREAK

There is always the possibility of the computer 'hanging up' during operation, due to overheating, power fluctuations, etc. If this ever occurs,

there is usually no option but to switch off and reload, thereby losing all data from memory.

As long as the **BREAK** key still functions however, Studio 8 copes with this situation by providing a special **Emergency File Option**. If the computer hangs up, not allowing you to save your music file, hold down **ESCAPE**, and tap **BREAK**. Your music file will be automatically saved to cassette or disc, under the filename "`M.BREAK`". The computer can then be re-started, and Studio 8 reloaded.

If using disc, rename the "M.BREAK" file to your chosen name with the command:

`*RENAME M.BREAK newname` **RETURN**

This will ensure that the file is not overwritten at a later date, should a similar emergency arise. The file can then be reloaded, so enabling you to continue at the point where you left off. Instrument settings, drive rate etc. will be unchanged.

APPENDIX A

Playing the Music Demos

A.1 Introduction

This section is intended to help you get the STUDIO 8 package up and running. It is split into two sections:

1. Running Studio 8.
2. Playing the Music Demos.

Throughout this section, the name of a key printed in bold text means 'press that key'. For example, **f0** means press the red function key labelled **f0** and then the **SHIFT** key so they are depressed together.

A.2 Running Studio 8

A.2.1 Cassette Users

Insert the tape into your recorder, then enter:

`CHAIN "STUDIO"` **RETURN**

Press play on your tape recorder. Shortly, the loader title screen will appear which will automatically load the main program `STUDIO 8`, followed by two data files `DAT1` and `DAT2`. After several minutes, the Studio 8 main screen will appear, labelled at the bottom `STUDIO FUNCTIONS` (see figure 1). Stop your recorder if you do not have motor control, but do NOT rewind as the tape is in the correct position to load the music demos provided. Proceed to section A.3 below.

A.2.2 Disc Users

Hold down **SHIFT** and tap **BREAK** to boot the disc in the usual manner. The loader screen will appear almost immediately, and several seconds later the Studio 8 main screen will appear, labelled at the bottom `STUDIO FUNCTIONS` (see figure 1).

A.3 Playing the Music Demos

Studio 8 comes with five music demos named `DEMO1`, `DEMO2`, `DEMO3`, `DEMO4` and `DEMO5`. This section explains how to load and then play each music demo from your cassette or disc.

The left column will tell you which keys you should press, and the right column will explain their effects.

1. **CTRL** **5** Press the **CTRL** key. The bottom window will change to read `PAGE SELECTION` (see figure 2). At the same time that **CTRL** is depressed, tap **5** the `filing` option. The `FILE CONTROL` screen will appear (see figure 8).

   Disc users will find that this part of Studio 8 is loaded from their disc.

2. **10** As indicated in the bottom window, **10** loads data from a file. When you press **10**, you will be prompted to enter a `filename`. Enter `DEMO1` and press **RETURN**. When the file has loaded, the → prompt will reappear.

   Cassette users should press play on their tape recorder, and stop when the file has loaded.

3. **CTRL** **10** Pressing **CTRL** and tapping **10** will return you back to the `STUDIO FUNCTIONS` screen.

4. **.** The **.** key starts the tape drive built into Studio 8. The music demo just loaded will start to play almost immediately.

5. **RETURN** When the music demo finishes, press **RETURN** to stop and reset the tape recorder back to `000`. You can play the piece again as described in instruction 4.

The other four music demos are loaded in exactly the same manner as described in instructions 1-5. Do not forget to change the filename in instruction 2, for example, to `DEMO2`.

A.4 Music Demo Description

DEMO1 A simple rhythm played solely on channel 0.

DEMO2 A rhythm and melody played on the four instrument channels.

DEMO3 A tune made up of pre-defined sequences.

DEMO4 A fully orchestrated classical piece involving pre-defined sequences, rhythms, and instrumental accompaniment. (From the 1812 Overture by Tchaichovsky.)

DEMO5 A modern piece composed with the Music Editor. (From Easy Winners by Scott Joplin.)

The four music demos DEMO1 to DEMO4 were composed and played using Studio 8 in real time, without using the Music Editor for any modifications.

APPENDIX B

A Worked Example

B.1 Introduction

The following example will explain step-by-step how to get instant results from Studio 8. The left column will tell you which keys you should press, and the right column will explain the effects.

If you are continuing from appendix A, you will first need to erase the demo music data by pressing **Q** followed by **10**. If not, simply load in Studio 8 from cassette or disc as described in section 1.3 or A.2 earlier. Do not worry if some of the instrument names in the example are different to those in Studio 8, as the default names may have been changed by the music demos.

B.1.1 Playing Instruments

1. **X**

   X is the first note on the musical keyboard. Pressing it plays the musical note `C`. The horizontal volume level indicator for `Piano2` will light up displaying the volume of the note.

   As indicated immediately above the musical keyboard display, any of the QWERTY keys `X D C...I 9 0` will play a note whose name will appear immediately below the keyboard; as the volume of the note fades, the brightness of its name decreases too.

   The octave number, `03`, is to the left of the keyboard, and may display `02` to `05` depending on the keyboard note pressed.

   Throughout this example, where you see **X** to **O**, it refers to any of the musical keys `X D C...I 9 0`.

2. **10**

   This key highlights the currently active channel. By default, this is `Piano2` on channel 1.

3. **10** ↑

   The current channel is changed by pressing the channel selector **10**, and then the **↑** key at the same time. Channel 0 will be highlighted; by default it is labelled `Beat`.

4. **X** to **O**

   The musical keyboard produces percussion sounds on channel 0. The keys **C** **V** **B** **N** **M** **<** will each sound differently when they are pressed.

5. 10 - The name of the instrument assigned to the highlighted channel is changed by using either - or = with 10. Even though some of the instruments are not designed to be percussive, they can still be played with the musical keyboard by pressing any of C V B N M <.

B.1.2 Playing Sequences

6. 10 ↓ Use these keys to move the channel highlight down to the horizontal sequence channel named `Rythm1`.

7. X to O Press any one of the musical keys to start the sequence. It consists of about ten notes that continually loop. Pressing a musical key a second time will restart the sequence from the beginning.

8. SPACE This causes the note or sequence to stop. The bar under the word `rel` to the left of the musical keyboard will highlight indicating that 'release' is selected.

B.1.3 The Tape Drive

9. ! On its own, the ! keys starts the tape drive displayed to the right of the horizontal channel and sequence indicators. You will notice that the tape counter starts incrementing, and an arrow beneath it shows the direction of play.

10. ! Pauses the tape drive.

11. - The - (or =) keys act as fast rewind or fast forward.

12. RETURN This resets the tape counter back to `000`.

13. 10 ↑ Select one of the instruments from the top four horizontal channels, such as `Piano2`.

14. SHIFT ! Pressing SHIFT followed by ! together will start the tape drive recording. The arrow below the tape counter is highlighted in red.

15. X to O Play several musical notes. Notice that the notes free counter on the top row decreases by one on each key press.

16. RETURN Stop and reset the recording.

17. ! Playback exactly what you have recorded. There might be a slight delay while you were deciding what to play.

B.1.4 Defining your own Sequence

18. **f7** The panel at the bottom of the screen will indicate EDITING SEQUENCE, and that the current recording is named MASTER.

19. **←** Holding down **←** will change the current sequence name from MASTER. Keep the key depressed until the name ****11**** is reached. If you go too far, the names of ten predefined sequences will appear, and you can use **←** to compensate.

20. UNIQUE Type a new name for your own sequence, UNIQUE for example.

21. **RETURN** Enters the name and returns you back to the STUDIO FUNCTIONS page.

22. Repeat points 12-16 in order to re-record a new sequence.

23. **10 ↓** Move down to one of the horizontal sequence channels such as Flange.

24. **10 ←** Change the name of the sequence until you reach your newly named sequence, UNIQUE.

25. **X** to **O** Press a musical key to start your sequence.

B.1.5 Improving your Sequence

26. **f8** The panel at the bottom of the screen will indicate SEQUENCE OPTIONS.

27. **f2** The panel at the bottom of the screen will indicate SEQUENCE LOOPING. The object is to make your newly created sequence loop continually at some specified point.

28. **RETURN** Reset the tape counter to **000**.

29. **1** Start to playback.

30. **1** After the notes have played back, pause in a position suitable to start looping.

31. **SPACE** Confirming the looping position will return you to the STUDIO FUNCTIONS page.

32. **X** to **O** Hitting any musical note will play back your newly created looping sequence.

33. F8 Reselect the SEQUENCE OPTIONS.

34. F1 Select the instant start option. After returning you back to the STUDIO FUNCTIONS page, you will find that any delay before the start of your sequence is lost.

B.1.6 Multi-sequences

35. By selecting a new sequence name as described from instruction 18 onwards, you can create a new sequence, this time containing the previously defined sequence. Hence sequences can consist of any number of previously defined sequences, each of which can be started at the press of a single key!

APPENDIX C

Lowering PAGE

C.1 Introduction

PAGE is a Basic variable which contains the start address in memory where the Studio 8 program begins. For disc users, this is often higher than necessary, especially if only limited disc commands are required – eg. LOAD, SAVE, CAT etc. As this high value of PAGE unnecessarily limits the amount of memory left for music data, it may be desirable to lower the value if a large amount of data are to be produced.

Unlike most machine-code software, Studio 8 can be loaded into any area of memory, and function perfectly. To do this, simply alter PAGE before loading the program. An extra 64 notes will become available for every &100 bytes subtracted from PAGE.

C.2 Gaining More Memory

When running Studio 8 from disc with the SHIFT BREAK function, PAGE will be set back to the default value. If page is to be lowered, the program must therefore be run directly. For example, turn on the computer and type:

```
PAGE = PAGE-&800 : CHAIN "STUDIO" RETURN OR
PAGE = &1100 : CHAIN "STUDIO" RETURN
```

There is a limit to the amount that can be subtracted from PAGE, depending on your DFS and the commands you wish to use. Some functions could corrupt the program, so it all depends on your own filing requirements. The lowest value for use with discs is normally PAGE = &1100, giving space for another 512 notes.

Some DFS's, such as Solidisk's STL0E00, will allow Studio 8 to load and run from PAGE = &E00, giving much higher music capacity while retaining all DFS functions. Conversely, a few DFS's, such as early Watford types, will not function with a lower than default PAGE value.

When BREAK is pressed, the system will re-initialise the file memory area. With PAGE lowered, Studio 8 will be occupying some of this memory, and can therefore be corrupted. Avoid the BREAK key in this situation, or the system may hang up – but see section 7.5.

APPENDIX D

Defaults

D.1 Introduction

Studio 8 contains 16 pre-defined amplitude envelopes, and 16 pre-defined pitch envelopes. The envelope parameters given below can be inspected and altered individually, using the envelope editor (section 4.3).

D.2 Envelope Defaults

AMPLITUDE ENVELOPES							PITCH ENVELOPES				
AA	AD	AS	AR	ALA	ALD	No	PI1	PI2	PI3	PN1	PN2	PN3
126	-2	-1	-8	126	63	1	0	0	0	0	0	0
126	-4	-1	-12	126	63	2	1	-1	1	1	2	1
126	-8	-1	-16	126	72	3	0	-48	0	1	1	1
126	-1	0	-2	126	63	4	96	-96	-48	1	1	1
24	3	0	-1	72	126	5	-48	96	-96	1	1	1
5	-16	0	-16	126	63	6	48	-48	48	1	1	1
7	63	0	-4	63	126	7	0	47	1	2	1	2
126	0	0	-126	126	126	8	48	-68	20	1	1	1
126	0	0	-1	126	126	9	-16	48	16	3	1	3
81	2	0	-2	81	126	10	16	16	16	1	1	1
18	1	0	-1	72	126	11	0	0	8	4	4	1
2	-126	0	-126	126	0	12	-16	16	0	1	1	1
4	1	-1	-126	55	126	13	-4	1	0	1	4	255
126	16	0	-16	126	63	14	4	-1	0	1	4	255
2	-1	0	-1	126	63	15	2	-2	2	1	2	1
126	-30	-30	-126	126	0	16	0	47	1	4	1	2

A wide range of effects can be obtained through careful combination of the amplitude and pitch envelopes, using the **Instrument Definer** page. Examples can be found in the pre-defined instruments shown below.

The following envelopes have not been used in the instrument definitions:

AMPLITUDE: 5,8,12,13,14,16
PITCH: 3,4,5,6,9,10,11,12,14,16

You can play around with these as much as you like in the envelope editor, without affecting the pre-defined instruments.

D.3 Instrument Descriptions

No	NAME	DESCRIPTION
1	**Piano1**	Soft piano effect for low octaves
2	**Piano2**	General piano effect for medium range
3	**Piano3**	Sharp piano effect for high octaves
4	**Organ1**	Electronic organ with sharp attack
5	**Organ2**	Reed organ with slow attack
6	**Vibra1**	Rapid vibrato effect combined with Piano2
7	**Vibra2**	More pronounced, slower vibrato
8	**Oboe**	Woodwind effect. Best with low octaves
9	**Beat**	General-purpose beat for percussion effects
10	**Bell**	Large or small hand-bell depending on octave
11	**Saw**	Musical saw at medium to high octaves
12	**Warble**	Kazoo played underwater!
13	**Koto**	Nothing like a koto
14	**Blip**	An acute envelope useful for percussive effects
15	**Bubble**	Raindrops or underwater bubbles
16	**Slide**	Quick slide up 1 semitone to the required note
17	**to 32**	General piano effect with short sustain

D.4 Instrument Defaults

		AMP STEP		PITCH STEP			
No	NAME	ENV	LENGTH	ENV	LENGTH	VOLUME	SUSTN
1	**Piano1**	4	1	1	1	15	26
2	**Piano2**	1	2	1	1	15	26
3	**Piano3**	2	1	1	1	15	6
4	**Organ1**	9	1	1	1	13	12
5	**Organ2**	10	1	1	1	13	16
6	**Vibra1**	1	2	2	1	15	26
7	**Vibra2**	1	2	15	2	15	26
8	**Oboe**	6	1	1	1	15	12
9	**Beat**	3	1	1	1	15	3
10	**Bell**	7	1	2	1	15	6
11	**Saw**	11	1	2	2	15	12
12	**Warble**	1	2	7	1	15	26
13	**Koto**	2	1	8	1	15	12
14	**Blip**	15	2	1	1	15	1
15	**Bubble**	2	1	7	2	15	8
16	**Slide**	1	2	13	1	15	28
17	**to 32**	1	1	1	1	15	8

APPENDIX E

Self-built Add-on Keyboard

Studio 8 is designed to make full use of the QWERTY keyboard for real-time music input, but the physical limitations make a real music keyboard desirable for serious use. There is a separate information sheet available describing how an external, full-size, professional-quality, 4-octave keyboard kit (including interface) can be constructed and connected to the BBC micro via the User Port in the same way as the ATPL Symphony keyboard.

When combined with the split-keyboard, manual sustain and polyphonic options provided in Studio 8, the result is an impressive and versatile musical instrument. Both the QWERTY and add-on keyboards are monitored at the same time, so no extra settings need to be made to use the music keyboard (but see section 6.7 on selecting between the two types of add-on keyboard).

The information sheet describes the components and tools required for the kit as well as full construction details. The components of the kit can be obtained, at the time of writing, from Maplin Electronic Supplies Ltd for approximately £45. To build the keyboard project will require a certain amount of electronic assembly skills and should only be attempted by those with suitable experience (or equivalent competence). To obtain full construction details, write to us enclosing a large (A5), stamped, addressed envelope, stating that you require the Studio 8 keyboard construction sheet.

APPENDIX F

Connecting an External Speaker

F.1 Introduction

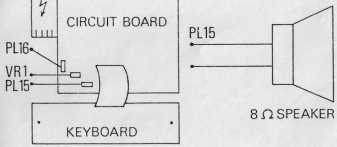
The BBC micro has the power to drive a larger speaker than its own built in one. The sound produced from Studio 8 is greatly improved if connected to an external loudspeaker, optionally via an amplifier.

Only carry out this modification if you are sufficiently competent since it may invalidate your guarantee. Beebugsoft will accept no liability for damage caused.

F.2 Connecting a Speaker

F.2.1 Accessing your BBC Micro

Ensure that the computer is turned off and unplugged from the mains supply. Take off the lid from your BBC micro by removing the four fixing screws. Release the keyboard by undoing its two (sometimes three) fixing screws.



NOT TO SCALE

Figure 9

Pull the keyboard forward to reveal to the left of the keyboard connecting ribbon cable, and next to the disc drive socket, a two pin plug labelled PL15. (see figure 9).

F.2.2 Reconnecting the Speaker

The BBC micro's own speaker is connected to the two pin plug labelled PL15. Unplug the internal speaker and connect your own. Use a similar connector rather than soldering your cable.

The new speaker lead can be redirected out of the BBC micro, either through the disused 'RESET' hole at the back of the computer, or through one of the connector sockets out of the front.

F.3 Adjusting Volume

If you have an issue 4 board or later, you will also be able to change the overall volume of the speaker by adjusting the variable resistor labelled VR1. This is a rectangular upright device near PL15 with a notch in its side that accepts a small screwdriver. Turning the notch will increase or decrease the sound volume.

Serious Software for The BBC Micro

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